Attachment 8

Quality Assurance

Quality Assurance

Paso Robles Groundwater Basin

Analysis of Groundwater Elevation Management Strategies

San Luis Obispo County, California

The plan participants understand that quality assurance is of the utmost importance to obtain high quality, defensible data and technical modeling results. All the technical review and QA/QC activities will be completed by a California Professional Engineer or Professional Geologist familiar with the Paso Robles Groundwater Basin and the available models but is not part of the project team completing the analysis. These reviews are scheduled throughout the project schedule at the completion of the individual activities as shown on the project schedule.

The technical review and quality assurance program activities are integrated into several of the tasks as described below:

- Task 1 – Establish Modeling Goals and Objectives will provide the basis for the QA/QC program by documenting the expectations and assumptions to be included in the overall project and the groundwater modeling activities.
- The technical review of Task 2 – Conduct Modeling and Document Results includes:
    - Checking the model input and output data with the original data sources (including the data from the updated model).
    - Evaluating the results of the modeled alternatives included in the AGEMS Program and comparing them to the sensitivity analysis model runs conducted for the model update described below to ensure the changes in groundwater in groundwater elevations is consistently within the expected range based on the two sensitivity analysis scenarios (increased or decreased future pumping).
- The cost estimates developed in Task 3 – Develop Project Costs and Implementation Considerations will be reviewed and checked to ensure appropriate unit costs and quantities are applied to each alternative.
- The results of Tasks 1, 2, and 3 will be documented in Technical Memoranda during the course of the project to facilitate timely review by the Steering Committee.
- The tasks will be discussed with the Steering Committee and other interested stakeholders at the scheduled Steering Committee Meetings.

Groundwater Model Update QA/QC Approach

The groundwater model update being conducted outside of this project is undergoing its own QA/QC process, including the steps below (taken from the work plan for the model update). The QA/QC process utilized in the model update provides assurances that the models and data used as the starting point for this project are complete and accurate.

- **Model Update Post-Audit** - A post-audit of the existing model will be performed by comparing the simulated groundwater levels from 1998 to 2011 against measured groundwater levels over the same period and at the same locations on the model grid as the observation wells from which they were measured. The purpose of a post-audit is to evaluate how well the existing calibrated model is able to match future groundwater levels (i.e., groundwater levels measured from 1998 to 2011) given inputs of the recharge and discharge components over that same future period. If the match between the simulated and measured groundwater levels from 1998 to 2011 is in relatively good agreement, then the existing calibrated model is assumed to be a valid predictor of future groundwater levels and no additional modifications to the model structure or assigned model layer hydraulic parameters is considered necessary for the updated model. Conversely, if significant differences exist between simulated and measured groundwater levels from 1998 to 2011 either locally or throughout the Basin, then a re-calibration of the model will be necessary.

- **Model Recalibration** - After the model inputs to the groundwater flow model have been implemented and the model subjected to a post-audit, a re-calibration of the model may be necessary to improve the fit between simulated and measured groundwater levels from 1998 through 2011. The objective of the model calibration is to adjust the appropriate hydraulic parameters (e.g., horizontal hydraulic conductivity, storage coefficients) and possibly modify particular recharge and discharge components until a reasonable match between the measured and modeled stream flows and hydraulic heads is achieved over the entire expanded base period of 1981 to 2011. The calibration of the groundwater flow model will be performed using both manual and automated approaches. The automated calibration will likely be performed using the PEST(Parameter ESTimation) software. The model calibration will be conducted according to the ASTM (1996) “Standard Guide for Calibrating a Ground-Water Flow Model Application."

- **Sensitivity Analysis and Simulations** - Once the updated groundwater model has been satisfactorily calibrated, a sensitivity analysis will be performed by evaluating the response of the calibrated model to changes in estimated hydraulic parameters or to changes in uncertain recharge and discharge components. Key parameters or components will be those that have the most significant impact on model results within their range of uncertainty. The values used in the sensitivity analyses should be within the range of uncertainty for each parameter. Selected model outputs (e.g., groundwater levels, storage changes) will be used to illustrate the results of the sensitivity analysis. The sensitivity analysis model runs will be compared to a baseline model run of the calibrated model, and two other scenarios (i.e., increased and/or decreased future pumping) to illustrate differences in results for a given parameter or component change. The results of the calibration sensitivity analysis will be evaluated according to the ASTM (1994) “Standard Guide for Conducting a Sensitivity Analysis for a Ground-Water Flow Model Application."